Applicant thanks the Examiner for the courtesy of an interview extended to Applicant's representative on October 23, 2002. During the interview, the differences between the present invention and the applied were discussed. No agreement was reached pending the Examiner's further review when a response is filed. Arguments presented during the interview are reiterated below.

Regarding the objections to the drawings, the reference numeral "150" at page 25, line 16 has been amended to be --150B--. Therefore, Figure 6 includes the reference numeral "150B" mentioned at page 25, line 16. Further, the specification has been amended at page 26, line 6; the reference numeral "170" has been amended to be --179--. Accordingly, Figure 6 includes the reference numeral 179 which is mentioned in the specification. Thus, it is respectfully requested this objection be withdrawn.

Regarding the Abstract, the Abstract has been amended in light of the comments noted in the outstanding Office Action and as shown in the marked-up copy. In particular, the process, process gas and impurity gas have been further clarified. No new matter has been added. Accordingly, it is respectfully requested this objection be withdrawn.

Regarding the objection to Claims 8, 13 and 17, Claims 8, 13 and 17 have been amended in light of the comments noted in the outstanding Office Action and as shown in the marked-up copy. Accordingly it is respectfully requested this objection be withdrawn.

Regarding the rejection of Claims 8, 13, 14 and 17 under 35 U.S.C. § 112, second paragraph, Claims 8, 13, 14 and 17 have been amended in light of the comments noted in the outstanding Office Action as shown in the marked-up copy. In particular, in Claim 8 the phrase "which is likely to react with said impurity gas in such a way as to lower the vapor pressure of said impurity gas" has been amended to be --to react with said impurity gas, in said exhaust gas at a location upstream of a pump to cause a reaction by-product to condense out of the exhaust gas at a point downstream of the mixing point--. Claim 14 has been

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amended to depend from Claim 24. Claim 13 has been amended to include "the inverse diffusion coefficient being set so that the oxidation gas is prevented from being introduced into the process apparatus through the exhaust bypass pipe." In Claim 17, an oxygen-containing gas and vapor has been amended to be --an oxygen-containing gas--. Accordingly, it is respectfully requested this rejection be withdrawn.

Claims 8, 12 and 17 stand rejected under 35 U.S.C. § 102(b) or under 35 U.S.C. § 103(a) as obvious over Horiuchi et al. This rejection is respectfully traversed.

Amended Claim 8 is directed to an impurity-gas removing method including, mixing, at a mixing point, a reaction gas to react with the impurity gas, in the exhaust gas at a location upstream of a pump to cause a reaction by-product to condense out of the exhaust gas at a position downstream of the mixing point. Further, trapping the reaction by-product using a trap mechanism and removing the reaction by-product from the trap mechanism.

As a non-limiting example, Figure 1 illustrates NH_3 gas 50 may be supplied into the exhaust pipe 30 as a reaction gas from the reaction-gas injection nozzle 46 of the reaction-gas feeding mechanism 44 (specification, page 16, lines 22-25). The NH_3 gas may react with the $TICl_4$ gas in the exhaust pipe 30 upstream of the pump forming a reaction by-product such as $TiCl_4 \cdot 2NH_3$ which has a significantly lower vapor pressure than the $TiCl_4$ gas (specification, page 16, line 25-page 17, line 5). Thus, the non-reactive residual gas is reacted mainly with the NH_3 gas and converted to a compound having a lower vapor pressure or HCl as a reaction by-product is reacted with the NH_3 gas and converted to a compound having a lower vapor pressure (specification, page 17, lines 9-13). Therefore, the by-products can be trapped and removed by the trap mechanism.

The Office Action indicates Horiuchi et al disclose a method for removing dimethyl aluminum hydride (DMAH) out of the exhaust gas emitted from a chamber that manufactures semiconductor wafers by injecting "dry air" into a deleterious material removing means

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which also receives the DMAH-contaminated exhaust gas so that the air *combusts* the DMAH in the exhaust gas into combustion by-products, which fall to the bottom and are removed from the exhaust gas in a manner that is not seen to be unobviously distinct from the limitations set forth in Applicant's Claims 8, 12 and 17 (Office Action, page 6, line 21-page 7, line 7). Further, the Office Action indicates the difference between the claims and Horiuchi et al is that Claim 8 calls for the reaction gas to react with the impurity gas to lower the vapor pressure of the impurity gas, and that this difference would have been obvious to one of ordinary skill in the art at the time the invention was made because Horiuchi et al indicate the combustion product falls to the bottom fairly suggests that the vapor pressure of the combustion product is lower than the vapor pressure of the DMAH.

However, as indicated in the Office Action, Horiuchi et al disclose a method in which DMAH reacts with dry air from the exhaust gas and the injection of dry air allows the DMAH to be combusted, in the exhaust gas, into combustion by-products. The claims however, utilize gasses in which a reaction by-product is yielded by condensing, rather than the chemical reaction of combustion disclosed in Horiuchi et al. The claims, for example, use gases different from Horiuchi et al. In fact, a non-reacted residual gas is reacted mainly with NH_3 gas to be converted to a compound having a lower vapor pressure or HCl as a reaction by-product is reacted with the NH_3 gas to be converted to a compound having a lower vapor pressure (specification page 17, lines 9-13). The residual gas easily and almost completely condenses, solidifies, and traps the gas in the trap mechanism 32 (specification, page 17, lines 13-15). Thus, the claimed invention makes it possible to generate a by-product in the vacuum atmosphere that is upstream of the pump, and with this structure, the inside of the pump is not contaminated with the impurity gas.

By contrast in Horiuchi et al such a combustion reaction carried out in the vacuum atmosphere would result in creating various types of problems. For example, combustion

wastes would be created, which contaminate the inside of the pump. Thus, Horiuchi et al do not solve the problem of contamination inside the pump. Further, Figure 1 of Horiuchi et al disclose that the removing means 40 is provided not on the inlet side but on the discharge side of the pump 100, and it is well-known the discharge side of the pump is at atmospheric pressure. Therefore, Horiuchi et al do not teach or suggest mixing, at a mixing point, a reaction gas to react with the impurity gas, in the exhaust gas at a location upstream of the pump to cause a reaction by-product to condense out of the exhaust gas at a point downstream of the mixing point, as recited in Claim 8. Accordingly, it is respectfully requested this rejection be withdrawn.

Claims 8, 12, 14 and 17 were rejected under 35 U.S.C. § 103(a) as unpatentable over Horiuchi et al. This rejection is respectfully traversed.

Claims 12, 14 and 17 depend from Claim 8, which as discussed is believed to be allowable. Accordingly, it is respectfully requested this rejection be withdrawn.

Claims 14 and 17 depend from Claim 8, which as discussed is believed to be allowable. Further, Iwata et al do not teach or suggest the features of the impurity-gas removing method. Accordingly, it is respectfully requested this rejection be withdrawn.

Claims 8 and 12-17 were rejected under 35 U.S.C. § 103(a) as unpatentable over Horiuchi et al and further in view of Iwata et al. This rejection is respectfully traversed.

In addition, new Claims 19-25 have been added to set forth the invention in a varying scope, and Applicant submits the new claims are supported by the originally filed specification. Further, Claims 19-23 depend from Claim 8, which as discussed is believed to be allowable. Further, the applied art does not teach or suggest these features. Accordingly, it is respectfully submitted new Claims 19-25 are also allowable.

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Consequently in view of the present amendment and in light of the above discussion, the present application is believed to be in condition for allowance and is respectfully requested

Respectfully submitted,

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Serial No: 09/718,483
Amendment Filed on:

IN THE SPECIFICATION

Please replace the paragraph at page 1, lines 12-17, as follows:

The present invention relates to an exhaust apparatus for a process gas, which is used in combination with a process apparatus for forming [a or] a layer on an object to be processed using the process gas, and relates to a method of removing an impurity gas (unprocessed gas, non-reacted process gas) formed by a process gas.

Please replace the paragraph at page 16, lines 10-21, as follows:

To the deposition of the Ti film generally consumes approximately 10% of the $TiCl_4$ gas, and the remaining gas (about [96%] 90%) as a non-reaction gas and reaction by-products of $TiCl_2$, $TiCl_3$ and HCl are fed into the exhaust pipe 30 from the exhaust ports 28 together with the exhaust gas by the vacuum pump 33. The exhaust gas further flows down in the order of the trap mechanism 32, the vacuum pump 33 and the eliminator 34. In this case, the non-reacting TiC14 gas, and the reaction by-products, have a relatively high vapor pressure, which are not generally possible to be sufficiently removed by the trap mechanism 32.

Please replace the paragraph at page 25, lines 8-21, as follows:

Second exhaust valves 150A, 150B are provided between the nozzle 162 and the upstream flange joint 146, and the downstream flange joint 148 and the vacuum pump 134 respectively. An exhaust bypass pipe 152 having a bypass valve 154 disposed therein is provided to communicate the bypass exhaust port 124 of the process container 106 with the portion 130A or the exhaust pipe 130 directly downstream of the second exhaust valve [150] 150B. The inner diameter of the exhaust bypass pipe 152 is, for example, 20 mm,

significantly smaller than the inner diameter of the exhaust pipe 130 which carries out main exhaust. The process container 106 can be therefore evacuated with a large inverse diffusion coefficient as will be discussed later.

Please replace the paragraph at page 25, line 22 to page 26, line 15, as follows:

Oxidative-gas feeding means 160 is connected to that portion of the exhaust pipe 130 which is located directly downstream of the first exhaust valve 140. Specifically, this oxidative-gas supply means 160 comprises a gas injection nozzle 162 whose distal end is inserted into the exhaust pipe 130 through the peripheral wall thereof, an oxidative gas pipe 164 connected to the nozzle 162, and an oxidative gas source 166. The gas injection nozzle 162 and the exhaust pipe 130 may be those illustrated in FIGS. 4A, 4B and 4C may be used. An oxidative gas valve 168 and a flow controller [170] <u>179</u>, which controls the flow rate of the oxidative gas are disposed in order in the oxidative gas pipe 164. Any gas which oxidizes and stabilizes a reaction by-product can be used as the oxidative gas. Although the O_2 gas is used in this embodiment, another gas, such as O_3 (ozone), a gas containing dry-air O_2 or H_2O (water vapor), can be used as well. The nozzle 162 may be provided in the trap mechanism 132 so as to directly feed the oxidative gas into the trap mechanism 132.

Please replace the paragraph at page 31, lines 15-19, as follows:

Next, the second exhaust valves [150] <u>150A, 150B</u> at the near the trap mechanism 132 are closed (S8), and both valves 142 and 144 at the upstream of the trap mechanism 132 are closed, sealing the trap mechanism 132 airtight and isolate it (S9).

Please replace the paragraph at page 34, lines 7-8, as follows:

Note that the downstream valve 144 may be closed, instead of closing the second exhaust valve [150] <u>150B</u>.

8. (Amended) An impurity-gas removing method of removing an impurity gas contained in an exhaust gas to be discharged from a process apparatus [for processing an object to be processed using a process gas], comprising:

[a step of] mixing, at a mixing point, a reaction gas to [which is likely to] react with said impurity gas, in said exhaust gas [in such a way as] at a location upstream of a pump to cause [lower a vapor pressure of said impurity gas into said exhaust gas, thus yielding] a

form in new matter

reaction by-product to condense out of the exhaust gas at a point downstream of the mixing point;[, and]

condensing condensed

trapping said reaction by-product using a trap mechanism; and

removing the condensed by product from the trap mechanism.

12. (Cancelled)

13. (Amended) The impurity-gas removing method according to claim [12] 24, wherein when said oxidative gas is made to contact said reaction by-product in said trap mechanism, said process apparatus is evacuated with [a large] an inverse diffusion coefficient [via] by an exhaust bypass pipe by the pump [so] provided [as] to bypass said trap mechanism, the inverse diffusion coefficient being set so that the oxidation gas is prevented from being introduced into the process apparatus through the exhaust bypass pipe.

14. (Amended) The impurity-gas removing method according to claim [12] 24, wherein stabilizing of said reaction byproduct sequentially and repeatedly is performed by trapping said oxidative gas at a pressure higher than that needed at a time of evacuating said trap mechanism and then exhausting said trapped oxidative gas plural times.

15. (Amended) The impurity-gas removing method according to claim [12] 24, wherein said reaction by-product is a product produced as a cleaning gas reacts with a by-product of a film deposition gas.

16. (Amended) The impurity-gas removing method according to claim [12] 24, wherein said process gas is one of a titanium-containing gas, tungsten-containing gas, tantalum-containing gas and silicon-containing gas.

17. (Amended) The impurity-gas removing method according to claim [12] 24, wherein said oxidative gas is at least one of an oxygen-containing [and vapor] gas.

19-25. (New)

IN THE ABSTRACT

Please replace the Abstract at page 47 to read as follows:

ABSTRACT OF THE DISCLOSURE

An exhaust apparatus for a process apparatus which processes an object using a process gas includes an exhaust pipe to be connected to an exhaust port of the process apparatus, and a trap mechanism connected to the exhaust pipe, for removing an impurity gas contained in an exhaust gas from the process apparatus. The process is for forming a layer on an object. The process gas reacts to form the layer. A reaction-gas supply mechanism is provided in the exhaust pipe at an upstream of the trap mechanism, for feeding a reaction gas which is reacted with the impurity gas in to exhaust pipe to lower a vapor pressure of the impurity gas. The impurity gas is unprocessed gas or non-reacted process gas which has not reacted to form the layer.